

The Wind ASSURE Team

The project team comprises 4 engineers at MA Systems and Control Ltd. , 2 external academic consultants and 3 industry subcontractors performing specific smaller roles.

Name	Dr Dennis Majoe	Qualifications	BSc., MSc., PhD., MBA.
Position	Technical Director		
<p><i>Background</i></p> <p>Dennis received his BSc in Electronic and Electrical Engineering (Loughborough University), his Masters in Cybernetics (London University, Chelsea College), his PhD in adaptive signal processing for GNSS (Loughborough University) and a Masters in Business Administration (Hertfordshire University).</p> <p>He is the founder of MA Systems and Control Ltd (est. 1991) which provides research and consultancy services as well as product design for OEM manufacture. The company has developed a range of health sensors and robotic equipments. It has been awarded several SMART Awards and has collaborated in several FP5,6 and 7 EU projects.</p>			
<p><i>Role</i></p> <p>Dennis will act as project manager in this project and will also provide the input for the concept design, energy harvesting design, electronic and software design and will manage the proof of concept evaluation.</p>			
<p><i>Relevant Work</i></p> <p>Always relying on innovation, the company has created several spin off companies. Motion Robotics Ltd., is one of them and has been working on both aerofoil design for aerial drones as well as energy harvesting. MA Systems, through Dennis, collaborates in the BodyPoweredSenSE project which uses the human body as the source of energy harvesting for wearable computing. One modality that the company is working on is the use of tribo-electric based energy harvesting in humans. It became clear that there is the potential to scale up for wind energy harvesting and it is this new research that influenced this proposal. Combining our robotics aerofoil energy ideas with energy harvesting lead to us make and evaluate a simple test rig seen below. The laboratory result convinced us of the approach and helped formulate the basis of this proposal. The test rig provides clear evidence of the aerofoil Bernoulli oscillatory force generation at low wind speed and the potential for energy harvesting. Using simple testing with low wind speeds of 4 or 5m/s we have generated forces of around 15Newtons per square meter, without any optimisation of the aerofoil design.</p>			
		<p>Given that the wind may provide oscillations of approximately 1m/s on average, it seems feasible that an energy harvest of 15Watts per square meter is possible at full efficiency. Since the static structures could contain around 70 square meters of aerofoil, then at low 4m/s wind speeds we could obtain 1KW and perhaps 3KW at 10m/s .</p> <p>Laboratory tests are being performed currently using PVC and Nylon laminates with Aluminium encapsulated foils for the capacitor plates based energy harvesting bench testing. Thus far the results follow exactly the published results we found on internet for other similar work for the energy, forces and voltages produced. See http://www.thesis.bilkent.edu.tr/0003354.pdf as typical of the state of the art.</p> <p>Most encouraging in our relevant work, is that the weight of materials used is very low, in the order of 1Kg per Square meter and the cost of materials is below £30 per square meter. If this can be maintained when scaling up in size, then a very low cost energy source may be feasible.</p>	

Name	Mr Han Yuan	Qualifications	BSc., MSc.
Position	Development Engineer		
<i>Educational Background</i>			
2011. University of Electronic Science and Technology of China BSc Computer Science 2014. Loughborough University (3+1+1 China partnership program) BSc Computer Science 2015. Loughborough University (3+1+1 China partnership program) MSc Computer Science			
<i>Role</i>			
Han will design the electronics that will be used to convert the capacitive energy into stored energy. He will also develop the monitoring software and hardware to remotely and continuously determine the efficiency of the system given motion of the aerofoils, the wind speed and direction etc.. and will compare all the data to the energy output. He will collaborate with Aston Brand (below) to bring data in real time into the energy efficiency model.			
<i>Relevant Work</i>			
Han is currently working on a monitoring system for a robotic humanoid. The monitoring system must measure direction and movement of the robot under different trip and shove conditions. The Wind ASSURE monitoring system will use many of the same components and ideas. To develop the energy conversion electronics he will rely on a relatively simple diode switching method which is well documented in the research literature.			

Name	Ms Aston Brand	Qualifications	BSc.,
Position	Modelling Engineer		
<i>Educational Background</i>			
Aston received her First Class Honours Bachelors Degree from Bath University reading Mathematics and Physics.			
<i>Role</i>			
Aston will contribute to the proof of concept that is the central objective of this project. In order to proof the concept we must as far as possible understand the physics of what is occurring within the quasi static structure. In particular we will mathematically model the energy conservation throughout the renewable energy system (by monitoring input output wind speeds and pressures, kinetic motion of the aerofoils and capacitor plates) and we will determine how close the oscillating Bernoulli suction system absorbs wind energy through a mix of drag and lift to determine how close we come towards the Betz Limit. https://en.wikipedia.org/wiki/Betz's_law We will also model the capacitive variation and forces and compare this with real values measured by Han Yuan's measurement system.			
<i>Relevant Work</i>			
Aston has already begun a mathematical study of the Bernoulli physics applied in our test rig. Having obtained input and output wind speeds and developed forces, she has started to determine how close her first approximation models are to the rough bench prototype.			

Name	Mr David Majoe	Qualifications	BSc.
Position	Product Design Engineer		
<p><i>Educational Background</i> David received a First Class Honours Bachelors Degree from Bath University reading Architecture and Civil Engineering.</p> <p><i>Employment History</i> Powell Dobson Swansea, 2011, Assistant architect. AVR London, 2013, 3D artist Rick Mather Architects, 2014, Assistant architect. Listed buildings and competition Proposals MA Systems and Control Ltd., 2016, Product and Structural Design Engineer</p> <p><i>CAD experience</i> David makes use of a wide variety of the most popular tools, RIVET, RHINO, 3DMAX, AutoCAD etc. specifically aiming at realistic visulisation</p>			
<p><i>Role in the project</i> David will carry out the Wind ASSURE aesthetic structure product design and integrate different structure designs into different urban contexts. These designs will be guided with the input from Professor Lehman at Portsmouth University from an Architectural point of view and from Dr Ajaj at Southampton University for the aerofoil design issues. They will be used within 3 focus group sessions to obtain feedback from both the general public and the architect community. Each focus group will be managed by him and refined so as to identify key design aspects that will provide proof of concept evidence supporting the proposed innovation.</p>			
<p><i>Relevant Work</i></p> <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;">  </div> <div style="width: 50%;"> <p>David has been working on two aspects of the WindASSURE typified in these artists impression architectural visualisations. The first is our route to market. The second is how to design static structures for wind energy harvesting with high likelihood of public acceptance. The visualisations show the Millenium Point meeting venue in Birmingham and the Arsenal FC Emirates stadium in London. Large stadiums and venues are being developed across the world and all of them are looking at including renewable energy into the infrastructure whilemaintaining architectural beauty. WindASSURE structures can be seen as aesthetic pillars guarding or adorning the architecture. Compare this to the image of revolving wind turbines! Thus the project will develop design guidelines for architects and our agents to blend functionality, beauty and renewable energy harvesting.</p> </div> </div>			

Steffen Lehman: [https://researchportal.port.ac.uk/portal/en/persons/steffen-lehmann\(075d47a2-a5cc-4bec-ba8f-42ba2d5cfc23\).html](https://researchportal.port.ac.uk/portal/en/persons/steffen-lehmann(075d47a2-a5cc-4bec-ba8f-42ba2d5cfc23).html)

PROFESSOR STEFFEN LEHMANN

- **Qualifications:** Dr-Ing, AA Diploma, Dipl Des, RIBA, RAlA
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- **Faculty:** Creative and Cultural Industries



Biography

I am Professor of Sustainable Architecture and lead the research theme on Sustainable Cities in the Faculty of Creative and Cultural Industries, and across faculties at the University of Portsmouth.

I am also Co-Director of the Cluster for Sustainable Cities, a cross-Faculty research concentration.

The Cluster for Sustainable Cities brings together a group of over 35 researchers and key industry partners with an interest in resilient urban futures.

Urbanisation is one of the defining processes of contemporary times. Our understanding of the urban, whether in theory or in practice, has reached a turning point, with cities across the world facing new, complex and challenging conditions that require resilience and adaptation to the impacts of environmental and social change.

I have joined the University of Portsmouth to conduct research in this field and to establish the interdisciplinary Research Cluster for Sustainable Cities. Prior to this, as a full professor for the last 13 years (since Dec 2002), I have held a range of senior leadership positions, from Head of School to Head of Discipline and Director of research centres. I have been in research intensive positions for the past decade. During this time I have had significant responsibility for creating and leading new urban research formations, generating a large publication and granting output and a continuous stream of successful research students. I was previously a tenured Chair and Professor of Sustainable Design at the University of South Australia, where I was founding director of two highly successful research centres (2010-14).

My research interests span architecture, urban design and sustainability with a strong focus on improving the environmental performance of buildings and neighbourhoods by introducing climate resilience. The main focus of my work over the past twenty years concerns urbanisation and the integration of low-carbon technologies into the societal/behavioural context. Current research includes the emerging field of low carbon precinct design combining strategies of passive and active building performance, and the adaptation of communities for climate change. I focus on solutions for a low carbon society, on resilient urban development and on technologies to optimise the resource-efficient city.

I believe architects and urban designers have a crucial role to play in developing strategies and adaptation solutions to ensure our cities are resilient, resource-efficient and sustainable in the face of intensifying global warming.

I am currently editorial board member for 4 international scientific journals. The fruits of my research are prodigious, including 16 books, numerous journal articles and conference papers, over 40 invited book chapters, encyclopaedia entries, online podcasts and contributions to UN reports. I have been advising the United Nations ESCAP and UNESCO organisations on urbanisation models and a 'New Urban Agenda'. In 2008, based on the international significance of my work, I was appointed a UNESCO Chair in Sustainable Urban Development for Asia and the Pacific (-2010).

From 2016 to 2018 I hold an Honorary appointment with the Institute for Sustainable Futures, at the University of Technology Sydney (UTS).

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Dr Rafic Ajaj is Lecturer in Aerospace Structures within Engineering and the Environment at the University of Southampton.

Dr Rafic Ajaj joined the department of Aeronautics and Astronautics at the University of Southampton on September 2013. His main research is focused on morphing aircraft and on developing adaptive and smart structural concepts that facilitate wing shape transformations. Currently, he is working (with Airbus Operations) on utilising folding wingtips for loads alleviation on large transport aircraft and he filed a patent with Airbus on this topic. Before joining Southampton, he worked as a lecturer in Aerospace Engineering for 3 months at Swansea University. He also worked as a researcher at the University of Bristol, Swansea University and Bauhaus Luftfahrt eV in Germany.